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BIOLOGICAL EVALUATION OF A MOUNTAIN PINE BEETLE INFESTATION IN GLACIER NATIONAL PARK, MONTANA Season of 1959

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BIOLOGICAL EVALUATION OF A MOUNTAIN PINE BEETLE INFESTATION IN GLACIER NATIONAL PARK, MONTANA
Season of 1959

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A lodgepole pine stand in Glacier National Park, Montana has been continually attacked by the mountain pine beetle, Dendroctonus monticolae Hopk., since about 1950. The infested area lies along the northwest shore of Lower Kintla Lake and extends northward up the slope of Starvation Ridge. The infested stand, about 400 acres in size, consists primarily of immature lodgepole pine trees from 8 to 16 inches in diameter interspersed with Engelmann spruce, Douglar-fir, and western larch trees.

The infestation has been appraised by personnel of the Missoula Forest Insect Laboratory several times since its discovery and the results have appeared in reports by Terrell[1/] and Fellin[2/].

A biological evaluation[3/] of the mountain pine beetle infestation at Kintla Lake was completed by the Laboratory, in September 1959. The evaluation was related to a study initiated by the Laboratory in the infested area during June 1958, the purpose of which was to determine a method of predicting the trend, and hence the probable severity, of a mountain pine beetle infestation in a lodgepole pine stand the following year.

1/ Terrell, Tom T. Mountain pine beetle infestation in Glacier National Park. Unpublished report of the Forest Insect Laboratory, Intermountain Forest and Range Experiment Station, Forest Service, U. S. Department of Agriculture, Missoula, Montana, May 1956.

2/ Fellin, David G. Mountain pine beetle infestation at Kintla Lake, Glacier National Park. Unpublished report of the Forest Insect Laboratory, Intermountain Forest and Range Experiment Station, Forest Service, U. S. Department of Agriculture, Missoula, Montana, December 1957.

3/ An appraisal of the entomological significance and potential destructiveness of a forest insect infestation.

COLLECTION OF DATA

The 1959 evaluation employed chain-wide strips established in a north-south direction at 5-chain intervals through the infested area between the lake shore and the top of Starvation Ridge. The boles of living and infested trees along the center line of the strips were marked with yellow paint to enable the re-examination of the strips annually. All beetle-attacked trees within the strip boundaries were tallied and blazed for future reference. One hundred lodgepole pine trees attacked by the mountain pine beetle in 1958 were used to sample the abundance and nature of developing beetle broods. Samples were obtained by removing 4 x 12-inch sections of bark from three locations at breast height on the bole of each infested tree. A record was made of the number of eggs, early-, mid-, and late-instar larvae, pupae, and callow adults found under the bark sections. The evaluation also used additional 4 x 12-inch bole bark samples in September to determine the number of emergence holes per square foot of surface made by new adult beetles of the 1958 generation in the same 100 infested sample trees. Also during September, the strips were surveyed to determine the number of 1959-attacked trees.

RESULTS

The evaluation showed no change in the boundaries of the beetle infestation in 1959 over those in 1958.

Beetle broods counted during the first week of July averaged 11.4 per square foot of bole bark surface. At this time the brood representing the 1958 generation consisted primarily of late-instar larvae, pupae, and callow adults. By September when most of this brood should have emerged as sexually mature new adult beetles, counts showed an average of only 3.6 per square foot of bark in the 100 sample trees. The reduction in brood between July and September--68.4 per cent--was probably due to several factors such as predation, parasitism, malnutrition caused by excessive drying of the cambium from woodpecker feeding the previous winter, and dessication of the insects themselves from the bark scaling of the feeding woodpeckers.

The beetles that emerged in September 1959 obviously were too few in number to sustain the infestation at the 1958 level. They attacked an average of only 0.6 per cent of the lodgepole pine stand in the study area, whereas an average of 1.4 per cent of the stand had been killed in 1958. The percentage of stand attacked and killed in 1959 was 57.2 per cent less than that in 1958.

The reduction in terms of the number of trees killed per acre was 63.6 per cent; from 2.2 trees per acre in 1958 to 0.8 in 1959. This is part of a decreasing trend that began after 1957, as revealed in the following tabulation:

Year	Number of beetle-killed trees per acre
1954	2.2
1955	4.4
1956	2.1
1957	4.7
1958	2.2
1959	0.8

If the infestation trend of the 1957-1959 period is projected into 1960, the beetle-caused tree mortality should revert to endemic status in that year.

DISCUSSION

Heavy woodpecker feeding on beetle broods within attacked trees has been evident during the winter months since 1957 at Kintla Lake. It is believed that this feeding occurred from a concentration of bird populations that probably first developed to abnormal abundance during an infestation of the Engelmann spruce beetle, Dendroctonus engelmanni Hopk., in the Park from 1952 through 1956. Engelmann spruce beetle broods at that time furnished much of the winter food of the woodpeckers and, because of the abundance of this food, tremendous increases in woodpecker populations occurred. With the natural decline of the spruce beetle infestation, the large bird population was left without adequate winter food, thus causing it to disperse and migrate in search of other food sources. It is possible that such a migration was responsible for the presence of large numbers of woodpeckers in the Kintla Lake area during the winter of 1957-58.

The feeding of these birds on mountain pine beetle broods in lodgepole pine stands during the winter of 1958-59 is unique in the northern Rocky Mountains, since past observations indicate that woodpecker flocks have seldom fed on broods of this insect in lodgepole pine. The reduction of the mountain pine beetle population since 1957 at Kintla Lake, like that of Engelmann spruce beetle populations during the period 1954-56, has probably resulted from intensified feeding by the woodpeckers on brood stages of the beetle.

A brief experiment was organized to gauge the amount of brood mortality caused directly or indirectly by woodpeckers. Portions of 11 trees attacked by beetles in 1958 were caged to eliminate bark pecking or the destruction of beetle brood. The uncaged bole bark on these trees was used as a check for mortality. Results indicated that the number of brood in uncaged bole bark on a tree could be reduced as much as 50 per cent if approximately 5 per cent of the bark was pecked. Woodpeckers not only destroy a beetle population by consuming the brood, but their feeding punctures in the bark allow easy access for insect predators and parasites, dry out the cambium layer, and cause exposed brood to die of dessication.

If the population of woodpeckers in the area during the winter of 1959-60 remains the same as that during the winter of 1958-59, the reduction of brood may result in even fewer trees being attacked in 1960. This is a good possibility, because of the relative abundance of woodpecker feeding noted during that part of the evaluation made in September of this year.

In summary, the biological evaluation in 1959 disclosed: no change in the infestation limits, fewer trees were killed than in any year since the origin of the infestation in 1954, and prospects for an end of the infestation in 1960 because of a predicted decrease in beetle emergence in the spring of that year.